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### **REMARKS**

Claims 1, 4-5, 8 and 31-32 and 34-56 are all the claims presently pending in the present Application. Claims 1, 5, 32, 41-42, 46 and 49 have been amended to more particularly define the claimed invention. Claims 53-56 have been added to claim additional features of the claimed invention.

It is noted that the amendments are made only to overcome the Examiner's non-statutory objections, and to more particularly define the invention and not for distinguishing the invention over the prior art, for narrowing the scope of the claims, or for any reason related to a statutory requirement for patentability.

It is further noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

Claims 1, 4-5, 8, 31, 34-35, 37-38, 41-45, 47-49 and 52 stand rejected under 35 U.S.C. §102 (e) as being anticipated by Yau et al. (US Patent No. 6,054,379).

Claims 32, 36 and 50-51 stand rejected under 35 U.S.C. §103 (a) as being unpatentable over Yau et al. (US Patent No. 6,054,379) as applied to claims 1, 4-5, 8, 31, 34-35, 37-38, 41-45, 47-49 and 52 above, and further in view of the Alleged Admitted Prior Art (AAPA)

Claims 39-40 and 46 stand rejected under 35 U.S.C. §103 (a) as being unpatentable over Yau et al. (US Patent No. 6,054,379) and further in view of Allada et al. (6,218,317 B1) alone or in combination with Chen et al. (Effects of slurry formulations on chemical-mechanical polishing of low dielectric constant polysiloxanes: hydrido-organo siloxane and methyl silsesquioxane).

These rejections are respectfully traversed in view of the following discussion.

#### **I. THE CLAIMED INVENTION**

The claimed invention (e.g., as recited, for example, in claim 1 and similarly recited in claims 5, 41-42 and 49) is directed to a semiconductor device having a multi-layered insulation film formed on a semiconductor substrate. The multi-layered insulation film includes a first insulation layer including an organosiloxane film having a dielectric constant which is lower than

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a silicon oxide dielectric constant, a second insulation layer including a polysiloxane compound having an Si-H group and formed on and adhering to a top of the organosiloxane film of the first insulation layer, and a third insulation layer including an inorganic material and formed on and adhering to a top of the second insulation layer. The device further includes a plurality of wires which are formed in grooves formed in the multi-layered insulation film, the multi-layered insulation film filling a space between the wires (Application at Figure 1; page 23, lines 10-15).

Importantly, the methylated hydrogen silsesquioxane (MHSO) layer adheres to the organosiloxane film and the inorganic material (Application at page 16, lines 8-21; Figure 3(b)).

Conventionally insulating layers may include an inorganic insulating layer (e.g., a silicon oxide layer) on an organic insulating layer. However, in devices formed by such conventional methods, during a subsequent planarizing step, peeling occurs at the interface between the organic and inorganic insulating layers, which can result in cross-talk between wires (e.g., wires which are separated by the insulating layers) in the semiconductor device (Application at Figure 5; page 2, lines 12-27; page 6, line 13 - Page 7, line 8).

The claimed invention, on the other hand, includes a second insulation layer which includes a methylated hydrogen silsesquioxane (MHSO) layer which adheres to the organosiloxane film and the inorganic material (Application at page 16, lines 8-21; Figure 3(b)). The improved adhesion may help to allow a surface of the third insulation layer to be planarized together with a surface of a wire formed in one of the grooves without causing a peeling of the third insulation layer (Application at page 23, lines 6-9; Figure 3(b)).

### III. ALLEGED PRIOR ART REFERENCES

#### A. Yau

The Examiner alleges that Yau teaches the invention of claims 1, 4-5, 8, 31, 34-35, 37-38, 41-45, 47-49 and 52. Applicant submits, however, that there are features of the claimed invention that are not taught or suggested by Yau.

Specifically, Applicant submits that Yau does not teach or suggest *"wherein said second insulation layer comprises a methylated hydrogen silsesquioxane (MHSO) layer which adheres to said organosiloxane film and said inorganic material"*, as recited in claim 1 and similarly

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recited in claims 5, 41, 42 and 49. As noted above, the improved adhesion may help to allow a surface of the third insulation layer to be planarized together with a surface of a wire formed in one of the grooves without causing a peeling of the third insulation layer (Application at page 23, lines 6-9; Figure 3(b)).

Clearly, these features are not taught or suggested by Yau.

**Indeed, the Examiner expressly concedes on Page 7 of the Office Action that Yau does not teach or suggest this feature.**

In view of the foregoing, the Examiner is respectfully requested to withdraw this rejection.

**B. The Alleged Admitted Prior Art (AAPA)**

The Examiner alleges that Yau would have been combined with the Alleged Admitted Prior Art (AAPA) to form the invention of claims 32, 36 and 50-51. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every feature of the claimed invention.

Indeed, Applicant submits that these references are completely unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

Further, Applicant submits that there is no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, these references clearly do not teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Further, neither Yau, nor the AAPA, nor any alleged combination thereof teaches or *"wherein said second insulation layer comprises a methylated hydrogen silsesquioxane (MHSQ) layer which adheres to said organosiloxane film and said inorganic material"*, as recited in claim 1 and similarly recited in claims 5, 41, 42 and 49. As noted above, the improved adhesion may help to allow a surface of the third insulation layer to be planarized together with a surface of a wire formed in one of the grooves without causing a peeling of the third insulation

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layer (Application at page 23, lines 6-9; Figure 3(b)).

Clearly, this feature is not taught or suggested by the AAPA. Specifically, the Examiner attempts to rely on Figures 8a-9b; page 2, lines 5-8 and 12-15 and page 5, lines 9-24 of the Application (e.g., the AAPA) to support his position.

However, the AAPA merely teaches a layer 2 including an organic material and layer 4 including an inorganic material. The AAPA teaches that in such conventional devices the layer 4 often peels away from layer 2 because of an insufficient adhesion (Application at page 2, lines 12-27).

However, the AAPA teaches that this problem may be solved by making layer 2 of hydrogen silsesquioxane (HSQ) (Application at page 3, lines 1-5). This is the only possible solution offered by the AAPA. Nowhere does the AAPA teach or suggest a layer formed between layer 2 and layer 4 in order to improve an adhesion between layer 2 and layer 4.

Thus, the AAPA clearly does not teach or suggest a methylated hydrogen silsesquioxane (MHSO) layer which adheres to layer 2 (e.g., a first insulation layer) and layer 4 (e.g., a third insulation layer), and certainly does not teach or suggest a methylated hydrogen silsesquioxane (MHSO) layer which adheres to an organosiloxane film and an inorganic material. Therefore, the AAPA clearly does not make up for the deficiencies of Yau.

Therefore, Applicant respectfully submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

### **C. Allada and Chen**

The Examiner alleges that Yau would have been combined with Allada and Chen to form the invention of claims 39, 40 and 46. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

In contrast to Yau, Allada is intended to address the problems involved with forming an undoped silicon glass (USG) hardmask on a polymer-insulated material without taking out a

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wafer from a spin-truck device, by producing multilayered wires in which both the hardmask and a layered insulation material are capable of being spin-coated.

Moreover, in complete contrast to Yau and Allada, Chen is intended to provide a method for chemically and mechanically controlling the chemical mechanical polishing (CMP) characteristics of polysiloxanes which have low dielectric constants.

Thus, clearly Yau Allada and Chen have completely different problems and objects to be solved. Thus, since the problems and objects to be solved differ between Yau and Allada, there clearly is no motivation to combine Yau and Allada as alleged by the Examiner. Further since the problems and objects to be solved differ between Allada and Chen, there exists no motivation to combine Allada (e.g., or the alleged Yau/Allada combination) with Chen.

In short, Applicant respectfully submits that these references are completely unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

In fact, Applicant submits that the references provide no motivation or suggestion to urge the combination as alleged by the Examiner. Indeed, these references clearly do not teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Moreover, neither Yau, nor Allada, nor Chen, nor any alleged combination thereof teaches or *"wherein said second insulation layer comprises a methylated hydrogen silsesquioxane (MHSQ) layer which adheres to said organosiloxane film and said inorganic material"*, as recited in claim 1 and similarly recited in claims 5, 41, 42 and 49. As noted above, the improved adhesion may help to allow a surface of the third insulation layer to be planarized together with a surface of a wire formed in one of the grooves without causing a peeling of the third insulation layer (Application at page 23, lines 6-9; Figure 3(b)).

Clearly, these novel features are not taught or suggested by Allada or Chen. Indeed, the Examiner attempts to rely on Figures 1a-1b and col. 2, lines 7-67 in Allada to support his position. However, Allada teaches merely using a "methylated oxide-type dielectric" as a hardmask to improve adhesion between the hardmask and an interlayer polymeric dielectric

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(Allada at col. 2, lines 16-19). Figures 1a-1b in Allada merely depict a device 10 including a silicon substrate 14, a diffusion barrier 12, a polymeric interlayer dielectric 16 and the methylated hardmask 18.

In fact, even assuming (arguendo) that Allada teaches a methylated hardmask, nowhere does Allada teach or suggest a methylated hydrogen silsesquioxane (MHSQ) layer **which adheres to an organosiloxane film and an inorganic material** (Application at page 16, lines 8-21; Figure 3(b)). Indeed, Applicant would again point out to the Examiner that the MHSQ layer in the claimed invention may be used to adhere a layer including **an inorganic material** (e.g., a third insulation layer) to a layer including **an organic material** (e.g., a first insulation layer). Nowhere is this taught or suggested by Allada.

Indeed, as noted above, Allada merely teaches that the methylated hardmask 18 is formed on the polymeric interlayer layer 16. Nowhere does Allada teach or suggest that the methylated hardmask 18 **adheres to an organosiloxane film and an inorganic material**.

In fact, Applicant would point out that the Examiner attempts to equate the layers 714, 716 and 718 in Yau with the second insulation layer of the claimed invention. The Examiner then alleges that one of ordinary skill in the art would have substituted the methylated hardmask 18 disclosed in Allada for the layers 714, 716 and 718 in Yau, to form the claimed invention. This is clearly incorrect.

Indeed, Applicant would note that the layers 714, 716 and 718 in Yau are formed between the layer 710 (e.g., parylene, FSG, or SiO) and layer 722 (low k dielectric layer). **Nowhere does Yau teach or suggest that either of layers 710 or 722 includes an organosiloxane film.** Therefore, even if the layers 714, 716, 718 in Yau would have been replaced with the methylated hardmask 18 in Allada, the alleged combination still would not teach or suggest a methylated hydrogen silsesquioxane (MHSQ) layer **which adheres to an organosiloxane film and an inorganic material**. Therefore, Allada clearly does not make up for the deficiencies in Yau.

Likewise, Chen does not teach or suggest these novel features of the claimed invention. Indeed, Chen merely discusses the chemical mechanical polishing (CMP) properties of a HOSP material. Nowhere does Chen teach or suggest any adhesive properties of a HOSP material. Indeed, Chen merely teaches spin coating a HOSP material onto a p-type silicon wafer (Chen at

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page 202, left col., first paragraph). Nowhere does Chen teach or suggest forming another layer on the HOSP material. Indeed, the sole purpose of Chen is to study the CMP properties of the HOSP material, not for study the adhesion properties of the HOSP material. Clearly, nowhere does Chen teach or suggest that the HOSP material **adheres to an organosiloxane film and an inorganic material.**

Further, as with Allada, the Examiner alleges that one of ordinary skill in the art would have substituted the HOSP material disclosed in Chen for the layers 714, 716 and 718 in Yau, to form the claimed invention. As noted above, this is clearly incorrect, since the layers 714, 716 and 718 in Yau are formed between the layer 710 (e.g., parylene, FSG, or SiO) and layer 722, and **nowhere does Yau teach or suggest that either of layers 710 or 722 includes an organosiloxane film.** Therefore, even if the layers 714, 716, 718 in Yau would have been replaced with the HOSP material in Chen, the alleged combination still would not teach or suggest a methylated hydrogen silsesquioxane (MHSQ) layer **which adheres to an organosiloxane film and an inorganic material.**

Therefore, Chen clearly does not make up for the deficiencies in Yau and/or Yau and Allada.

Therefore, Applicant respectfully submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

### III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 1, 4-5, 8 and 31-32 and 34-56, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

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The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully submitted,

Date: 3/28/06



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**CERTIFICATE OF FACSIMILE TRANSMISSION**

I hereby certify that the foregoing was filed by facsimile with the United States Patent and Trademark Office, Examiner Julio Maldonado, Group Art Unit #2823 at fax number 571-273-8300 this 28th day of March, 2006.



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